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Dataset Information:

Funding_Info: NOAA Climate Program Office; NOAA Ocean Acidification Program
Initial_Submission: 20141124
Revised_Submission: 20160130

Cruise Information:

Experiment Name: HB1405-Leg4
Experiment Type: Autumn Bottom Trawl and Acoustic Survey, SOOP Line
Platform Type: Ship
Co2 Instrument Type: Equilibrator-IR or CRDS or GC

Cruise ID: 33HH20141028
Cruise Info: Autumn Bottom Trawl and Acoustic Survey, AOML_SOOP_CO2
Geographical Region:
- Westernmost Longitude: -71.4
- Easternmost Longitude: -66.6
- Northernmost Latitude: 45.0
- Southernmost Latitude: 41.4

Cruise Dates (YYYYMMDD)
- Start_Date: 20141028
- End_Date: 20141113

Ports of Call:
- Newport, RI

Vessel Name: Henry B. Bigelow
Vessel ID: 33HH
Vessel Owner: NOAA

Variables Information:

Variable Name: xCO2_EQU_ppm
Description of Variable: Mole fraction of CO2 in the equilibrator headspace (dry) at equilibrator temperature (ppm)
Unit of Variable: ppm

Variable Name: xCO2_ATM_ppm
Description of Variable: Mole fraction of CO2 measured in dry outside air (ppm)
Unit of Variable: ppm

Variable Name: xCO2_ATM_interpolated_ppm
Description of Variable: Mole fraction of CO2 in outside air associated with each water analysis. These values are interpolated between the bracketing averaged good xCO2_ATM analyses (ppm)
Unit of Variable: ppm

Variable Name: PRES_EQU_hPa
Description of Variable: Barometric pressure in the equilibrator headspace (hPa)
Unit of Variable: hPa

Variable Name: PRES_ATM@SSP_hPa
Description of Variable: Barometric pressure measured outside, corrected to sea level (hPa)
Unit of Variable: hPa

Variable Name: TEMP_EQU_C
Description of Variable: Water temperature in equilibrator (°C)
Unit of Variable: Degree C

Variable Name: SST_C
Description of Variable: Sea surface temperature (°C)
Unit of Variable: Degree C

Variable Name: SAL_permil
Description of Variable: Sea surface salinity on Practical Salinity Scale (o/oo)
Unit of Variable: ppt

Variable Name: fCO2_SW@SST_uatm
Description of Variable: Fugacity of CO2 in sea water at SST and 100% humidity (µatm)
Unit of Variable: µatm

Variable Name: fCO2_ATM_interpolated_uatm
Description of Variable: Fugacity of CO2 in air corresponding to the interpolated xCO2 at SST and 100% humidity (µatm)
Unit of Variable: µatm

Variable Name: dfCO2_uatm
Description of Variable: Sea water fCO2 minus interpolated air fCO2 (µatm)
Unit of Variable: µatm

Variable Name: WOCE_QC_FLAG
Description of Variable: Quality control flag for fCO2 values (2=good, 3=questionable)
Unit of Variable: None

Variable Name: QC_SUBFLAG
Description of Variable: Quality control subflag for fCO2 values, provides explanation when QC flag=3
Unit of Variable: None

Method Description:

Equilibrator Design:

Depth of Seawater Intake: 3 meters
Location of Seawater Intake: Bow
Equilibrator Type: Spray head above dynamic pool with thermal jacket
Equilibrator Volume: 0.95 L (0.4 L water, 0.55 L headspace)
Water Flow Rate: 1.5 - 2.0 L/min
Headspace Gas Flow Rate: 70 - 150 ml/min
Vented: Yes
Drying Method for CO2 in Water:
Gas stream passes through a thermoelectric condenser (~5 °C) and then through a Perma Pure (Nafion) dryer before reaching the analyzer (90% dry).
Additional Information: Primary equilibrator is vented through a secondary equilibrator.

CO2 in Marine Air:

Measurement: Yes, 5 readings in a group every 3.5 hours
Location and Height: Mast above the bridge, ~18 meters above sea surface
Drying Method:
Gas stream passes through a thermoelectric condenser (~5 °C) and then through a Perma Pure (Nafion) dryer before reaching the analyzer (90% dry).

CO2 Sensor:
Measurement Method: IR
Manufacturer: LI-COR
Model: 6262
Frequency: Every 140 seconds, except during calibration
Resolution Water: ± 0.01 µatm in fCO2_SW
Uncertainty Water: ± 2 µatm in fCO2_SW
Resolution Air: ± 0.01 µatm in fCO2_ATM
Uncertainty Air: ± 0.5 µatm in fCO2_ATM
Manufacturer of Calibration Gas:
Std 1: JA02645, 204.74 ppm, owned by AOML, used every ~3.5 hours. Std 2: JA02273, 317.49 ppm, owned by AOML, used every ~3.5 hours. Std 3: JB03591, 409.69 ppm, owned by AOML, used every ~3.5 hours. Std 4: JA02647, 518.24 ppm, owned by AOML, used every ~3.5 hours. Std 5: 0.00 ppm, owned by AOML, used every ~17.0 hours.
Number of Non Zero Gas Standards: 4
CO2 Sensor Calibration:
The analyzer is calibrated every 3.5 hours with field standards that in turn were calibrated with primary standards that are directly traceable to the WMO scale. The zero gas is ultra-high purity air.
Other Comments:
Instrument is located in an air-conditioned laboratory. Ultra-High Purity air (0.0 ppm CO2) and the high standard gas are used to zero and span the LI-COR analyzer.
Method References:
Pierrot, D., C. Neil, K. Sullivan, R. Castle, R. Wanninkhof, H. Lueger, T. Johannessen, A. Olsen, R. A. Feely, and C. E. Cosca (2009), Recommendations for autonomous underway pCO2 measuring systems and data reduction routines, Deep-Sea Res II, 56, 512-522.
Details Co2 Sensing:
details of CO2 sensing (not required)

Measured Co2 Params:
xco2(dry)

Sea Surface Temperature:
Location: After sea water pump, ~3 m below sea surface
Manufacturer: Seabird, Inc.
Model: SBE 38
Accuracy Degrees Celsius: 0.001
Precision Degrees Celsius: 0.0003
Calibration: Factory calibration
Comments: Manufacturer's Resolution is taken as Precision; Maintained by ship.

Equilibrator Temperature:
Location: Inserted into equilibrator ~5 cm below water level
Manufacturer: Hart
Model: 1523
Accuracy Degrees Celsius: 0.015
Precision Degrees Celsius: 0.0003
Calibration: Factory calibration
Comments: Resolution is taken as Precision.

Equilibrator Pressure:
Location: Attached to equilibrator headspace. Differential pressure reading from Setra 239 attached to the equilibrator headspace is added to the pressure reading from the LICOR, which is measured by an external Setra 270 connected to the exit of the analyzer.
Manufacturer: Setra
Model: 270
Accuracy hPa: 0.15
Precision hPa: 0.015
Calibration: Factory calibration
Comments:
Manufacturer's Resolution is taken as Precision.

Atmospheric Pressure:
Location: On mast above the bridge at ~18 m above sea surface water
Manufacturer: Vaisala
Model: PTB220
Accuracy: ± 0.15 hPa
Precision: 0.01 hPa
Calibration: Factory calibration
Normalized: yes
Comments: Manufacturer's Resolution is taken as Precision; Maintained by ship.

Sea Surface Salinity:
Location: In dry lab after a debubbler, next to CO2 system
Manufacturer: Seabird
Model: SBE 45
Accuracy: ± 0.005 o/oo
Precision: 0.0002 o/oo
Calibration: Factory calibration
Comments: Manufacturer's Resolution is taken as Precision; Maintained by ship.

Additional Information:

The CO2 system behaved fine throughout this cruise. Due to bad weather, the ship suspended operations for 51 hours starting at 15:00 on 1 November. For 62 analyses after the CO2 system was restarted, the ship's data was not appended in real time and the TSG-45 did not have water flow. For these analyses, the barometric pressure and SST data were taken from the ship's 15-second average file and the salinity was assigned a value of 33 psu. Original Data Location: http://www.aoml.noaa.gov/ocd/ocdweb/bigelow/bigelow_introduction.html

Preliminary Quality Control:

NA

Form Type:

underway